Aalto University

MS-E2177
COVID-19 impact on credit loss modelling

Group SEB: Project plan

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1 Background

Our client is SEB, a leading Nordic financial services group founded in 1856. SEB is serving and advising 4,4 million customers in Nordics, Baltics, and Germany with strong focus on institutional and corporate clients.

Our case study is about lending business, one of bank's major areas of business. In general, most of the debts will be paid back in time. However, there are also cases where customers default, meaning they are unable to pay back parts or the full amount of the loan due to financial distress. After customers default there are two possible outcomes. They might be able resolve their financial problems and continue with the payments, or they are unable to resolve the issues and go bankrupt. In the case of bankruptcy, banks might be able to recover remaining debt by selling collateral or from other possible sources. [1] For this project we are focusing on the probability of default (PD) and will not go further to examine bankruptcy or resolving procedures.

Credit losses can have serious impact on bank's business. In order to protect their business from potential losses, banks estimate the probability for such events and set aside capital to absorb losses. PD is one of the major components of credit loss estimation. Currently, SEB is using Merton-Vasicek one factor model to estimate PDs:

$$\text{PIT} = \Phi\left[\frac{\Phi^{-1}(\text{TTC}) + \sqrt{\rho}Z}{\sqrt{1-\rho}}\right]$$

The model estimates point-in-time (PIT) PD under certain economic circumstances by through-the-cycle (TTC) idiosyncratic risk, systematic risk Z, and sensitivity of the customer to the economical environment ρ [2]. Currently, SEB uses single economic driver and a single sensitivity variable and applies that into a large portfolio.

Although the above-mentioned method works in normal economic conditions, the COVID-19 pandemic has created additional complications. Firstly, it has been observed that some sectors have received negative credit rating actions such as leisure and transport while other sectors such as technology and utilities have experienced rating affirmations [3]. Secondly, size and rating are also factors as smaller firms with lower credit rating are more affected by economic downturn [4, 5]. Lastly, SEB also noted that the actual default rates are lower than predicted, implying that government support also play a role.

Our task is to improve the existing Merton-Vasicek model to account for the differences in sensitivities across sectors, rating and size, as well as the impact COVID-19 government supports.

2 Objectives

The goal of the project is to enhance the existing Merton-Vasicek model of SEB to fit better to the new macro-economic environment under the COVID-19 pandemic. Currently, the model is used to calculate the probability of default under certain economic circumstances in a one-year horizon and SEB is using the single economic driver and a single sensitivity variable applied in a large customer portfolio. Our focus is to find a way to implement changes in the model to improve results during periods of changing correlations. Changes will be explored on a level of economic environment, sectors, and credit quality of individual

clients. Finally, we also seek to find a way to implement the effects of governments' COVID-19 support on the probability of default.

Our main goals are the following:

- Calibration of the Merton-Vasicek model on a risk rating level
- Calibration of the Merton-Vasicek model on industry/sector level
- Implementation of sector level stress testing
- Creating a metric for COVID-19 government support and integrate into newly built model to predict PDs

3 Tasks and schedule

Our main tasks are and tentative timeline for the project is as followed:

By the delivery date of the project plan

- Conduct literature review
- Perform exploratory data analysis with sample data
- Find alternative data sources

By the delivery date of the interim report

- Set up data processing pipeline
- Perform hypothesis testing to determine effects of ratings and sectors
- Replicate SEB model
- Experiment with new models, different calibration methods, and clustering of companies

By the delivery date of the final report

- Complete the model that includes the impact of COVID-19 government support
- Validate and test for sensitivity
- Finalize results and final report

The core tasks of the projects revolve around the development and testing of new models that account for ratings and sectors, which are expected to take a large portion of our time. Other tasks such as processing and finding new data, while take less time, can be carried out in parallel through out the project. Our complete schedule is available in the GANTT chart on the appendix page.

4 Resources

The team consists of four students with background in mathematics and operations research, engineering, and data science. Overall, the team has the good technical background that is required to work on the project. Furthermore, as there is also a diversity in each student's

field of specialization, which can result in more effective team work. Members can choose tasks that are most suitable to their own strength, and offer multiple perspectives on the subject.

The project owner is Roger Stahlman from SEB. Roger has introduced us to the project and equipped us with the appropriate background knowlegde on the first two initial meetings. He will also provide data as well as giving feedback and guidance where possible during the course of the project. Professor Ahti Salo and teaching assistant Patrik Lahti will also help with guiding us and monitoring our progress.

Our tentative source of data is Global Credit Data (GCD), which aggregates data collected its from member banks. GCD data is anonymized and comes with well defined structures and labeling, which would serve as a good starting point for the project. Access to internal data from SEB is also possible through Roger if the need arises.

In term of tools, we have a good selection of programming languages such as Python or R that comes with a variety of well supported packages. Propriety tools such as Matlab could also be considered with access from Aalto. For computing power, aside from our own personal computers, we also have remote access to work stations and light computing servers that the university provides.

5 Risks

In our project, there are mainly risks relating to data and model quality, and communication. Specific risks are evaluated in term of probability, effects, and mitigation strategies in Table 1.

Risk	**Probability**	**Effect**	**Impact**	**Mitigation Strategy**
Poor data quality or incomplete data	Low	Decrease quality of final solution	High	Careful inspection of data, filter and clean data
Delay in data provision	High	Shorten time of developing and testing models	High	Active communication with contact person
Model too complex for the scope of the course	Moderate	Too wide problem to solve for the allocated time	High	Clear formulation and scoping of the problem. Establish explicit goals.
Model incorporates too simplified model assumptions	Moderate	Model pictures not the goals of the project, client not satisfied with the solution	High	Clear Communication with the client and agreeing on model assumptions
Model does not describes the observed phenomena	Low	Model can be useless for the client	High	Discussing the assumptions and interim results with the client
Data security	Low	NDA contract violation	High	Local data management, risk assessment preceding deadlines
Inadequate communication between team members	Moderate	Resentment due to imbalance in workload between team members, misunderstandings	Moderate	Regular communication between team members and manager and scheduling
Insufficient communication between team and client	Moderate	Client not satisfied with the solution	High	Regular communication with the client
Team member inactivity or dropout	Low	High workload for other team members	High	Good communication between the project manager and the rest of the team. Clear schedule.

Table 1: Evaluation of risks

References

[1] A. M. Malz, *Financial risk management: Models, History, and Institutions*, vol. 538. John Wiley & Sons, 2011.

[2] M. Kalkbrener, A. Onwunta, *et al.*, "Validating structural credit portfolio models," *Model risk—identification, measurement and management. Risk Books, London*, pp. 233–261, 2010.

[3] International Organization of Securities Commission, "Observed Impact of COVID-19 Government Support Measures on Credit Ratings," 2021.

[4] S. Agarwal, B. Ambrose, L. Lopez, and X. Xiao, "Did the Payment Protection Program Help Small Businesses? Evidence from Commercial Mortgage-backed Securities," 2020.

[5] T. Jensen, D. Lando, and M. Medhat, "Cyclicality and Firm-size in Private Firm Defaults," *International Journal of Central Banking (Forthcoming)*, 2016.

Appendices

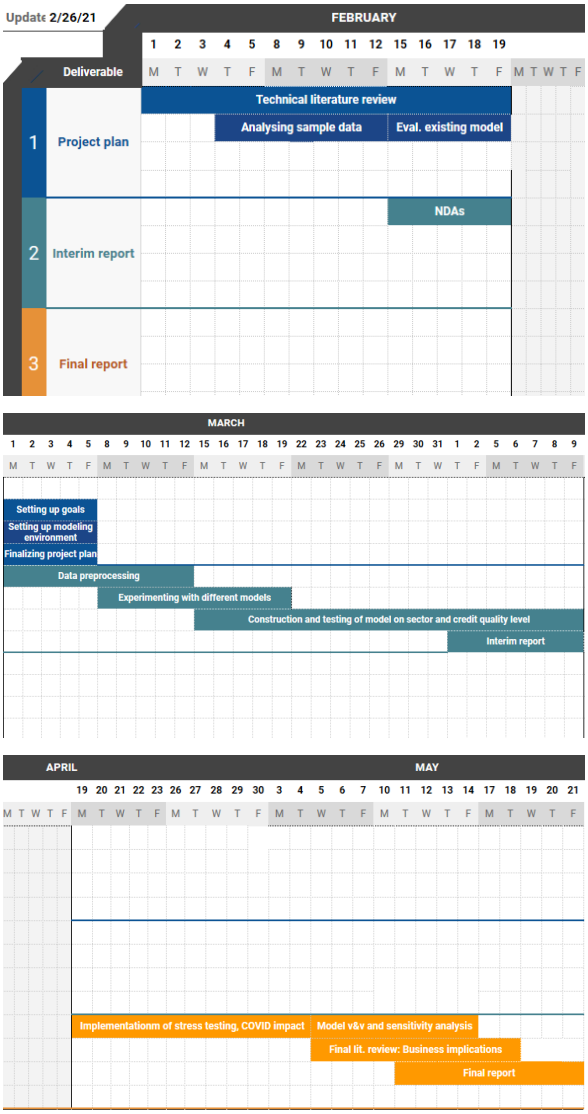

Figure 1: Project schedule. The full schedule can be accessed **here**